Lat 40.19202 Lon -121.32145

Forest Pest Management

Pacific Southwest Region

File Code: 3420 Date: March 9, 2001

Subject: Black stain root disease in Stand 57, Fanani Compartment (NE01-01)

To: District Ranger, Almanor RD, Lassen NF

On January 3, at the request of Judy Welles (Silviculturist), I examined a number of dead and dying ponderosa pine trees in Stand 57 of Compartment 374 (Fanani Compartment) and confirmed that *Leptographium wageneri*, the cause of black stain root disease is actively killing trees there. The purpose of this visit was to provide Forest Pest Management (FPM) input for treating black stain root disease in Stand 57. I was accompanied by Judy Welles, Danny Cluck (FPM Biologist) and Dave Oliver (Lead Forestry Technician).

The primary management objective for Stand 57 is commercial timber production. In the 1992 Lassen National Forest Land and Resource Management Plan, Stand 57 falls under the Timber (T) prescription which emphasizes full timber management. In reviewing the stand record cards, Stand 57 is a 68-year-old, Dunning site class I, mixed conifer stand mostly stocked (85% by basal area) with ponderosa pine. White fir is 10 % of this stand while sugar pine and incense cedar together are 5%. Approximately 3% of the trees are over 26" DBH and 11% are under 8". The remainder are small sawtimber sized pine trees. In 1982 the stand had approximately 255 ft^2 basal area; and in 1988 it was thinned to below 200 ft^2 basal area. In 1998, the stand was thinned again to less than 175 ft^2 basal area. The normal stocking for Stand 57 (Dunning and Reinecke, 1933) is 280 ft^2 basal area and this stand is now about 60% of this.

In between the two commercial thinnings (1988 and 1998), some dead and dying trees were harvested from Stand 57. The cause of this mortality is unknown, but it occurred during the extended period of below normal precipitation that started in the late 1980's and extended to the mid 1990's. Currently, an estimated 1% to 2% of the ponderosa pine trees in Stand 57 are

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dead or dying. The mortality is present in the intermediate and suppressed trees (8"- 16"dbh). Black stain root disease is causing some, and possibly most of this mortality. The disease was confirmed in the most recently killed trees by the presence of the black streaking in the outer wood at the base of the trees. Some of these recently killed pines may have been infected through root contact with adjacent older dead trees which may have been killed by black stain root disease following the 1998 thinning operations. The cause of the older mortality could not be determined because of advanced deterioration of the wood.

Leptographium wageneri is a native pathogen that has been killing conifers in northern California pine stands in increasing numbers. The strain of the fungus that kills ponderosa and Jeffrey pine (*L. wageneri var. ponderosum*) is currently active in Stand 57. Black stain root disease has not been reported in this area before. The nearest known occurrence of black stain disease at this time is 6 miles east of Stand 57 in the Prattville area (See FPM Evaluation # NE00-09). The Prattville black stain root disease outbreak occurred prior to 1993 and may be the source of the *L. wageneri var. ponderosum* that is infecting Stand 57.

Black stain root disease is difficult to control. The disease is spread long distances by insect vectors that carry spores from infected trees to uninfected trees as they feed on roots. Tree-to-tree spread occurs through the roots. Infected trees do not always show clear crown symptoms, making it impossible to know the extent of the disease infestation. A pine tree with black stain root disease may appear healthy and survive an infection indefinitely or it may become stressed, become infested with bark beetle vectors, lose foliage and die in one or two years.

We know that overstocked ponderosa/Jeffrey pine growing on cooler/wetter sites that have a history of mechanical disturbance are most likely to be infected by black stain root disease. We also know that the root feeding vectors of the disease are most active in spring and early summer. Insect vectors are attracted to wounded trees, fresh stumps, and probably any host trees that are stressed. Logging activity results in an increase in vector abundance and provides them with breeding habitat in the form of stumps. Small ponderosa or Jeffrey pine trees (saplings and poles) which are under stress appear to be most vulnerable to black stain root disease. Larger pine trees growing next to black stain infection centers sometimes survive (or escape) the disease. This may be because their roots may not be in contact with infected roots, or it may be related to the health and vigor of the larger trees. For a more complete discussion of this disease, see Tree Notes # 25 (July 2000), "Black Stain Root Disease of Ponderosa Pine in California" by Don Owen (included with this report).

In unmanaged forests, the function of black stain disease may be to infest overstocked young pine stands, thereby killing many of the stressed pine trees. This would open up the stands and increase the vigor of the surviving trees. Vigorously growing trees may be less attractive or more resistant to the root feeding vectors of the disease. Also, trees growing in open stands have fewer root contacts with neighboring trees and therefore have a lower risk for local root-to-root spread of the disease.

Historically, recurrent ground fires kept the trees in the forest widely spaced. These open forests would have been less susceptible to black stain root disease for the reasons given above. With the advent of fire suppression in managed forests, dense conifer regeneration resulted. Because these

crowded trees are stressed, they are likely to be infested by insects and diseases. By managing open forests, insect and disease mortality should be reduced to near historic levels (ie. mortality levels that existed in the past, when the trees in many forests were at wide spacings because of frequently occurring underburns).

In Stand 57, it is unknown whether black stain root disease was a factor in the pine mortality that occurred in the late 1980's and early 1990's. Likewise it is not certain that the black stain fungus killed the intermediate and suppressed pine that died in the late 1990's. This is most likely what happened, since black stain root disease in now present and since some of the recent harvest activity was reported to have occurred in early summer when the beetles that vector the black stain fungus are most active.

In the 1992 Lassen National Forest Land and Resource Management Plan, Stand 57 falls under the Timber (T) prescription, which emphasizes full timber management. Because one of the objectives of this prescription is to produce wood products for harvest, it is desirable to minimize tree mortality in Stand 57.

Management Options

No Action

Most likely, root feeding vectors of black stain root disease were attracted to stressed pine trees in Stand 57 during the thinning operations in 1998. Any remaining stressed pine trees in the stand will most likely attract root feeding beetles which may vector the disease. Since the Stand 57 is currently stocked well below normal, most of the trees should be growing vigorously. Trees growing in clumps or overtopped trees may be stressed and therefore at higher risk. Pine trees that become infected with *L. wageneri var. ponderosum* may transmit the disease to adjacent pine through root contacts.

Small group selection around infection centers

Removing all of the live pine trees in each black stain infection center, plus all immediately adjacent healthy appearing pines (which possibly have root contact and may have early stages of the disease in their roots) will eliminate the visible black stain root disease from the stand. This will leave some undetected black stain infected pines due to the fact that diseased trees may not show symptoms early in the infection process. Subsequent treatments will be needed to remove the mew pine mortality as it appears. Pine seedlings planted in the created openings should not be infected by the diseased roots of the harvested black stain trees because the black stain fungus does not live long in dead roots. Dead pine trees killed by black stain root disease may be left on the site or removed without adversely affecting black stain control efforts. Harvest operations (disturbance) should not be conducted mid-April through June when the beetle vectors are thought to be most active.

Reduce host stocking

Reducing the stocking of the pines throughout Stand 57 will accomplish three things which can reduce black stain mortality. First, the health and vigor of the residual pine trees will be enhanced,

making these trees less attractive to the root feeding beetles that vector black stain root disease. (As stated above, Stand 57 is currently stocked well below normal, therefore most of the trees should be growing vigorously. Nevertheless, removing any remaining stressed pine trees in and around Stand 57 can reduce the risk of continued black stain related mortality.) Second, there will be less root contact between trees, reducing the tree-to-tree spread of the disease should a tree become infected. Third, the open stands will have warmer soil temperatures which may inhibit growth of *L. wageneri*. Of course, the further the trees are spaced apart (ie. the more aggressively the stand is thinned), the more each of these three factors can reduce black stain root disease in the stand. (See Figure 1 showing an aggressively thinned area. Note: this level of thinning may be necessary only if black stain root disease in Stand 57 intensifies. Even though the stand is currently stocked at 60% of normal, more aggressive thinning may be needed to stop mortality from *L. wageneri var. ponderosum.*)

Small group selection with reduced host stocking

By clearing the host trees from within and around known black stain root disease centers and aggressively thinning Stand 57, the most complete black stain root disease control can be achieved. This option will remove all visibly diseased pine trees plus adjacent healthy trees that may have root contact with the diseased trees. In addition, pine trees outside the black stain centers will be removed in order to widely space the residual pines so that vigor will increase, root contact will decrease and the soil between the trees will be warmed by the sun. All these conditions should reduce the risk of black stain mortality in the future.

Figure 1. Aggressively thinned pine stand

Summary

Black stain root disease has been actively killing ponderosa pine in Stand 57 for at least the last several years. Since root feeding beetles which vector the disease are attracted to stressed pine trees, the overtopped and crowded trees are at risk to becoming infected. Future treatments (group selection, aggressive thinning, or a combination of the two) can reduce the risk of future black stain mortality in the stand. Leaving the stand untreated will most likely result in continued black stain activity in the stressed pine trees that remain (especially during prolonged periods of below normal precipitation). Some healthy pine trees adjacent to diseased trees may become infected through root contact. Management objectives for the area should determine which course to follow.

Please contact me at 530-252-6680 (voicemail) or wwoodruff@fs.fed.us (internet) if you have any questions or requests.

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Enclosure: 2) Tree Notes #25 (July 2000), "Black Stain Root Disease of Ponderosa Pine in California"